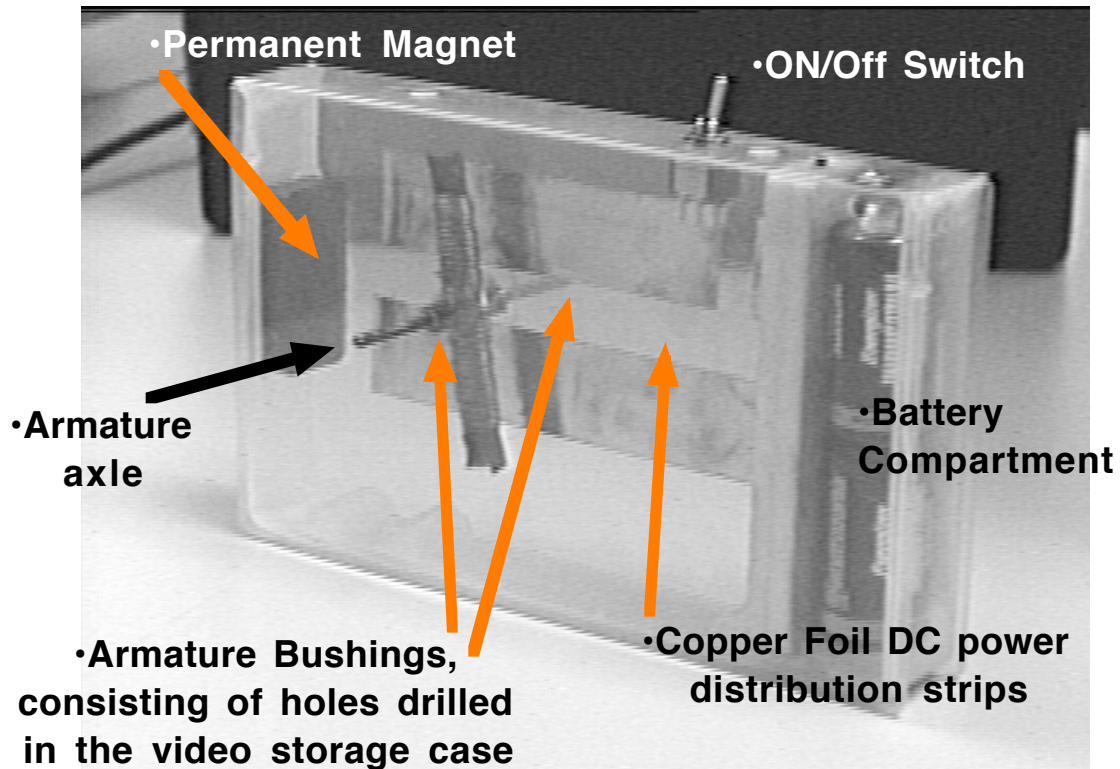


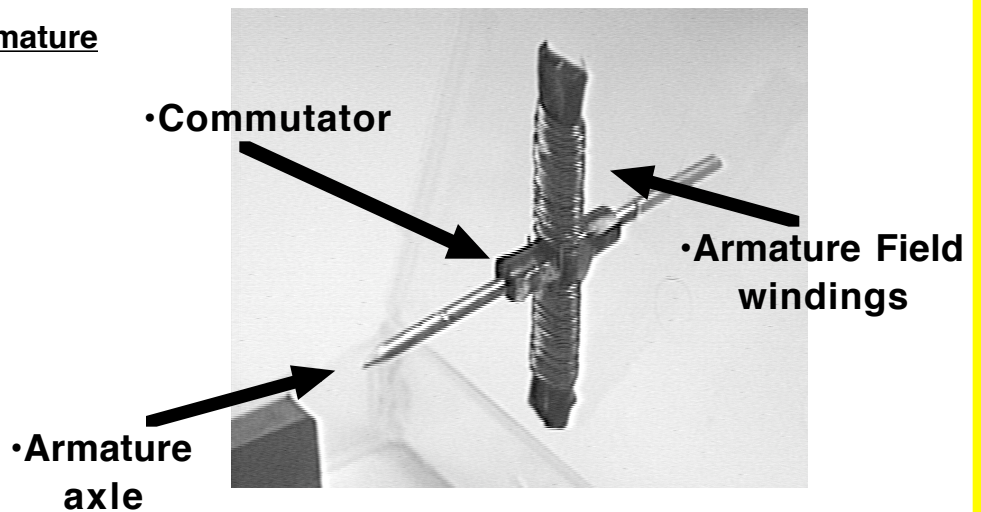
# THE NEW NAIL MOTOR

Students will be building a permanent magnet dc motor using ordinary nails for the construction of the armature. The Motor is enclosed in a semi-transparent video tape storage box, so all components of the nail motor are visible in operation.

**Fig A The Nail Motor components**

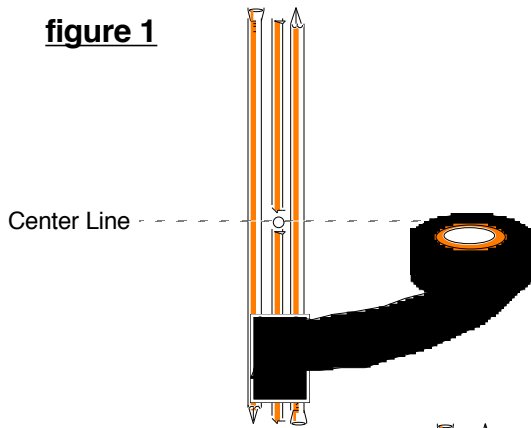


**Fig B Closeup of Armature**



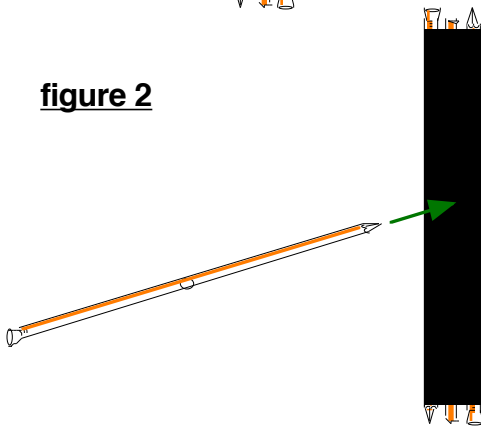
Recently an ancient nail motor was found in an Egyptian Tomb.  
 It was discovered that it operates on AD or BC

**figure 1**



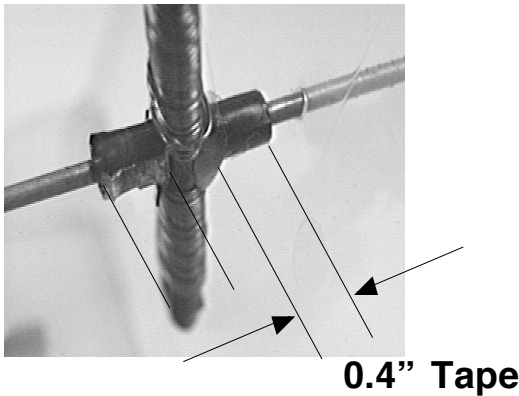
Two nails are joined with two sections of cut nails to form a symmetrical pole assembly. Leave enough room in the center at center line for insertion of armature axle.

**figure 2**



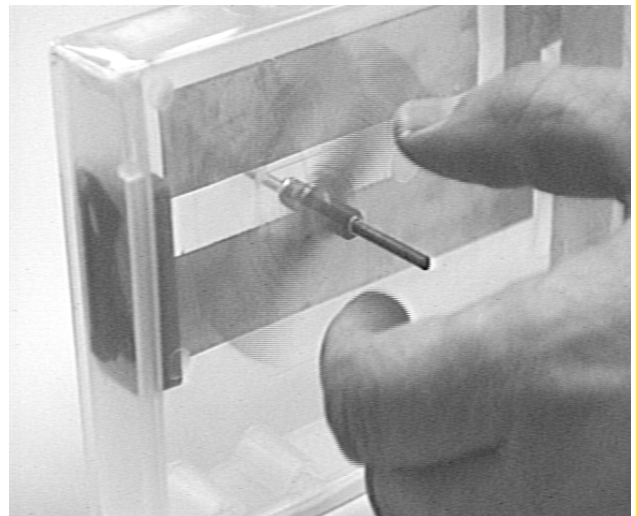
Push another nail through the center of the armature pole assembly. This section forms the axle of the armature and will also support the commutator.

**figure 3**



Wrap electrical tape on armature axle creating a platform for attaching the commutator contacts. Place the layers of electrical tape on both sides of the armature winding cores tightly and neatly in order to secure the core from movement.

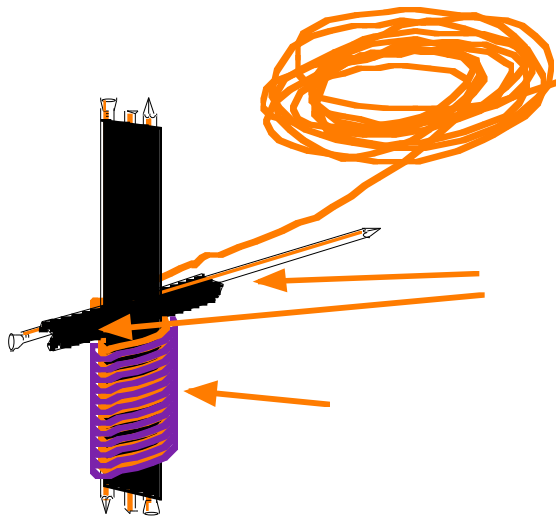
**figure 4**



**The FIRST balance test:**

Install the armature in the case and spin. The armature should spin freely and not wobble. If there is a wobble. Disassemble and start over with figure 1.

**figure 5 Winding the Armature**

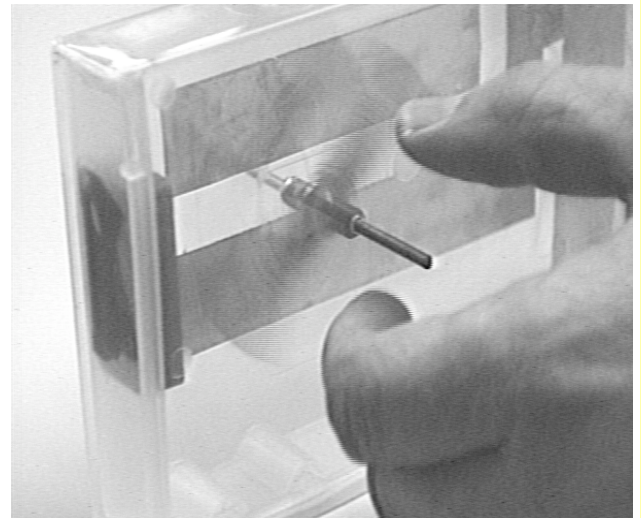


Four meters of 24 gauge solid magnet wire is used for the nail motor armature. Half or two meters is wrapped on each half of the armature pole in the same direction. Do not Cut the wire in sections but split it in half and start winding each 1/2 section at time. **NEATNESS COUNTS. MAKE YOU WRAPS SYMMETRIC AND CLOSE TOGETHER.**

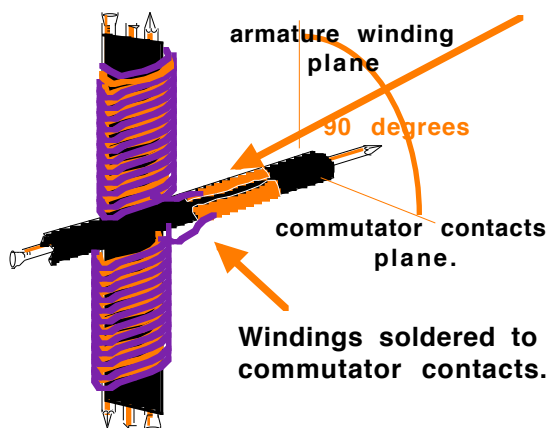
When finished you may find the ends of the wire at opposite poles. Try to adjust your winding technique so the ends of the wire fall at the axle.

**The SECOND balance test:**

After applying the wire windings install the armature in the case and spin once again. The armature should spin freely and not wobble. If there is a wobble, disassemble and start over with figure 5. Make certain that the wire is applied smoothly and evenly distributed on both halves of the armature as shown in the figure.



**figure 6 Installing the Commutator Contacts**



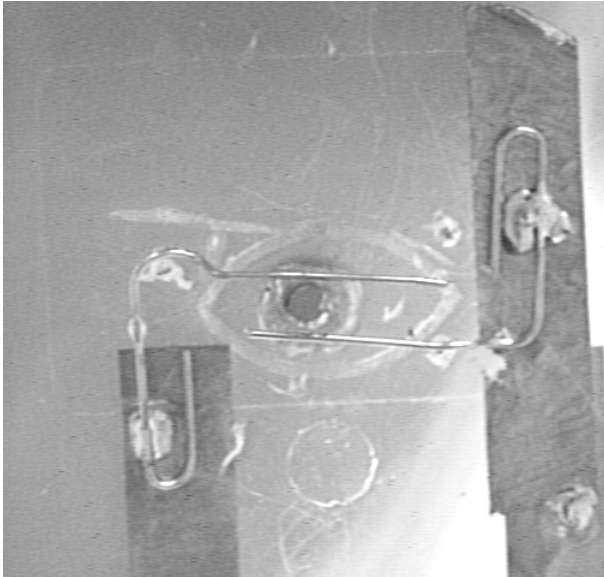
Self adhesive copper foil attached to commutator axle, 90 degrees of rotation from the armature windings. This is the contact that reverses the polarity of the armature field magnet. These contacts should be oriented 90 degrees off axis with the pole pieces and cover only 1/4 of the circumference of the armature axle.

Note the orientation of the commutator contacts with the armature windings. It is very important that the commutator contacts be aligned at right angles to the armature windings.

Once the Commutator contacts have been attached and soldered, coat all of the copper foil with a light layer of solder.

**PERFORM THE THIRD BALANCE TEST !**

**figure 6 Installation of the Brushes**



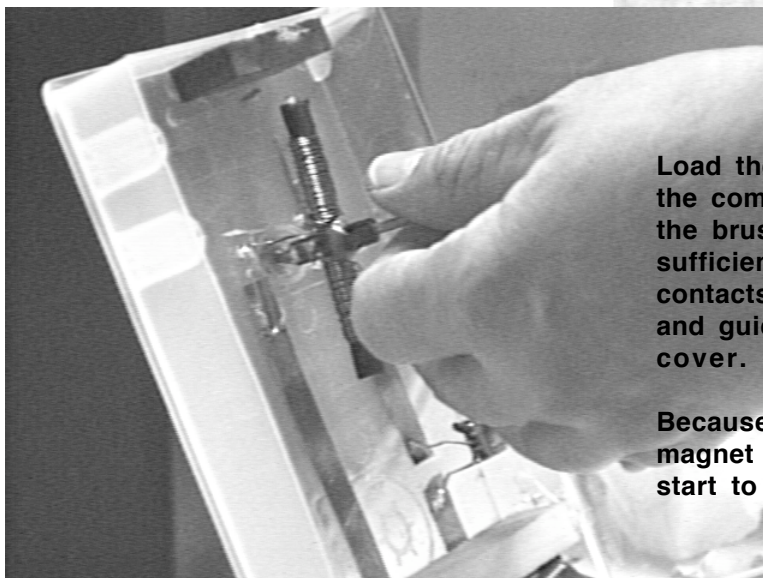
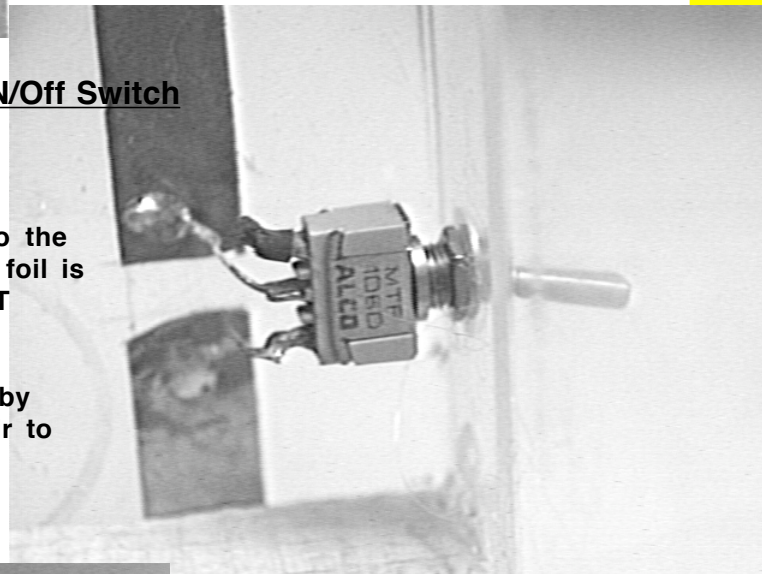
The brushes of the motor are fabricated from two Paper Clips. Bend and cut two clips and solder them to the copper foil power distribution strips as show in Figure 6.

After installation and at any time the brushes can be adjusted for position and tension on the commutator contacts..

**figure 7 Installation of the Power ON/Off Switch**

The power distribution is handled by self adhesive pieces of copper foil attached to the bottom of the VCR tape box. The copper foil is split to form the contact points for a SPST switch.

Select the correct contacts of the switch by making a test to determine the correct pair to wire.



**figure 8 Armature Loading**

Load the Armature into the VCR box by placing the commutator end of the axle in first. Inspect the brushes to make certain that they have sufficient tension to contact the commutator contacts. Angle the other end of the armature and guide it into the hole in the VCR tape box cover.

Because this motor only has one permanent magnet you may need to give the armature a start to get it to operate.